MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

ECE 3086 – MULTIMEDIA TECHNOLOGIES AND APPLICATIONS

(All sections / Groups)

12 OCTOBER 2016
9:00 a.m – 11:00 a.m
(2 Hours)

INSTRUCTION TO STUDENTS

1. This question paper consists of 5 pages (including cover page) with 5 questions.
2. Attempt all **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer Booklet provided.

QUESTION 1

(a) Explain the reason why multimedia data is used to represent information. Discuss and give one example or application to justify your explanation.

[4 Marks]

(b) The quality of a media presentation depends on a number of encoding parameters. However changing these parameters can increase the media size.

i) A stereo audio stream is digitized with pulse code modulation (PCM) method. The encoding setting use 12 bits per sample and 44100 samples/sec. Compute the bit rate of the audio stream.

[2 Marks]

ii) A colour image is represented as digital bitmap image with resolution of 640x480 pixels. The bit depth is 24 bits/pixel. Compute the image size.

[2 Marks]

(c) The audio stream in Question 1(b) i) is required to be transmitted through a network with a capacity of 512 kbit/s. Is the network able to support the transmission of the audio stream? Suggest one method to enable the transmission without affecting the audio quality and changing the network bandwidth. Show calculation to justify your answer.

[2 Marks]

Continued ...

QUESTION 2

(a) Table 1 shows the probability distribution for five symbols used in a communication system.

i) With the use of Huffman coding method, design the optimal variable length code for the symbols. You will need to show the codeword for all the symbols.

[4 Marks]

Table 1

Symbols	Probability of Occurrence
P	0.30
Q	0.25
R	0.22
V	0.14
W	0.09

ii) Compute the efficiency of the codes obtained in Question 2 (a) i)

[2 Marks]

(b) LZW is a dictionary based coding method that can be used to compress text files. The dictionary is first initialized with the following code. Use the LZW encoder to compress the following sequence. You will need to show the generated output sequence.

Sequence to be encoded: xxyyxy

Initial dictionary

Symbol	Index
x	0
y	1

[4 Marks]

Continued ...

QUESTION 3

(a) JPEG is one of the most popular image compression method for digital photography. With the use of a block diagram, explain the various processes involved in converting raw images into compressed format that is stored in JPEG file. Label each process category as either lossless or lossy.

[6 Marks]

(b) The compression method employed in JPEG uses the observations in human visual system and characteristic of photographic images. Explain how these two observations are used in JPEG encoder to obtain high compression ratio.

[4 Marks]

QUESTION 4

(a) The following diagram in Figure 1 shows the threshold curve for human hearing. Explain the experiment procedure to obtain such curve.

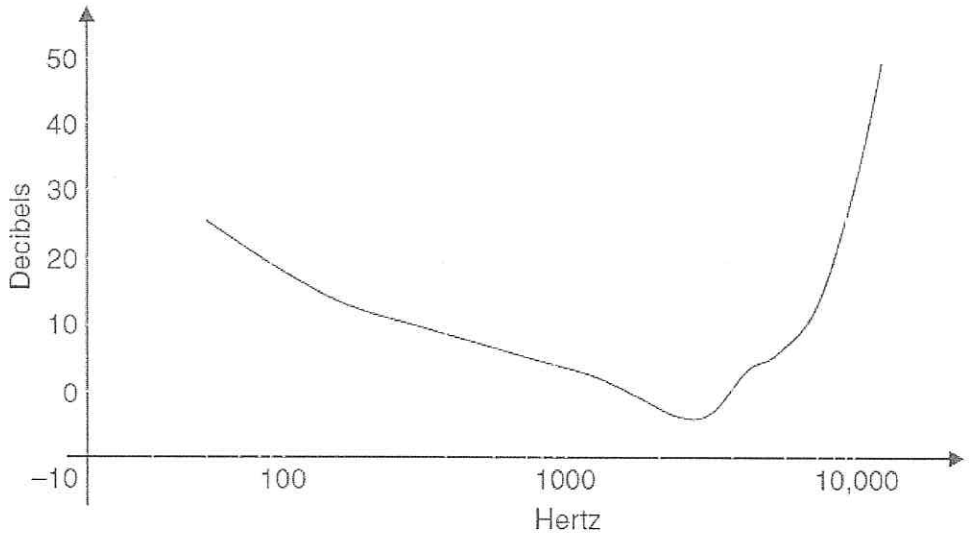

Figure 1

[3 Marks]

Continued ...

QUESTION 4

(b) A loud tone of 1000 Hz is generated in a quiet room. Explain the effect of this loud tone on the hearing threshold curve. Draw the threshold curve for human hearing when this loud tone is present. Then, explain a strategy used by the perceptual encoder such as MPEG 1 layer 3 (MP3) that make use of this phenomena in compressing audio signal.

[4 Marks]

(c) The quality of quantization is defined by the peak signal-to-quantization-noise ratio (PSQNR). Assume an audio signal that varies between $-V_{max}$ and $+V_{max}$ and it is digitized with **N** bits per sample. Use simple derivation to prove that PSQNR = 6.02**N**. Assume uniform quantization is used.

[3 Marks]

QUESTION 5

(a) Video **cameras** use RGB format to represent colour videos. However before the video is compressed or transmitted, the colour format is changed to YUV or YC_bC_r. Briefly explain the justification for the colour transformation.

[2 Marks]

(b) CCIR-601 (NTSC) uses video resolution of 480x720, 30 frames/sec frame rate, 8 bits for each colour component value (Y,U and V) and a 4:2:2 chroma sub-subampling scheme. Compute the bit rate for the raw video stream.

[2 Marks]

(c) It is desired to reduce the raw video bit rate calculated in Question 5(b) to 10 Mbits/sec. Propose changes to the chroma subsampling method to further reduce the video data rate. Compute the required compression ratio to justify your proposal.

[2 Marks]

(d) Video compression standard such as the H.261 uses the I and P frames. Briefly discuss the difference between the I and P frames. Explain why P frame give higher compression rate when compared with I frame.

[4 Marks]

End of Paper